
SIGN LANGUAGE

Four important things to know about sign languages

① **There are hundreds of sign languages**. Sign languages vary from place to place. For example, British Sign Language and American Sign Language are not mutually intelligible.

② The grammar of a **sign language does not mirror** or depend on the grammar of **the surrounding spoken language**.

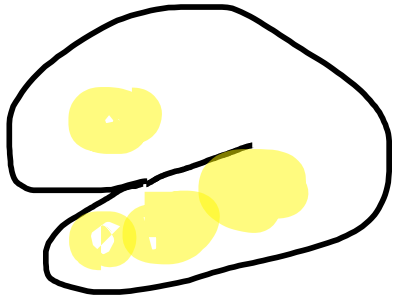
③ Sign languages are **fully fledged linguistic systems** with a phonology, morphology, syntax and semantics.

④ Signing is **not a form of gesturing**.

- Although signers do gesture, just like speakers do.
- But rather than gesturing with their hands, they gesture with their face or other parts of their body (Emmorey, 1999)

Questions

- Why has language “set up shop” where it has in the brain?



Questions

- Why has language “set up shop” where it has in the brain?
  - Has it set up shop in locations that are convenient for the auditory modality, that is, spoken language?
  - Is that is so, sign languages might localize differently.
- Is sign language as left lateral as spoken language?
- To what extent are the neural bases of signed and spoken languages similar in the details?
  - Specific computations
  - Timing

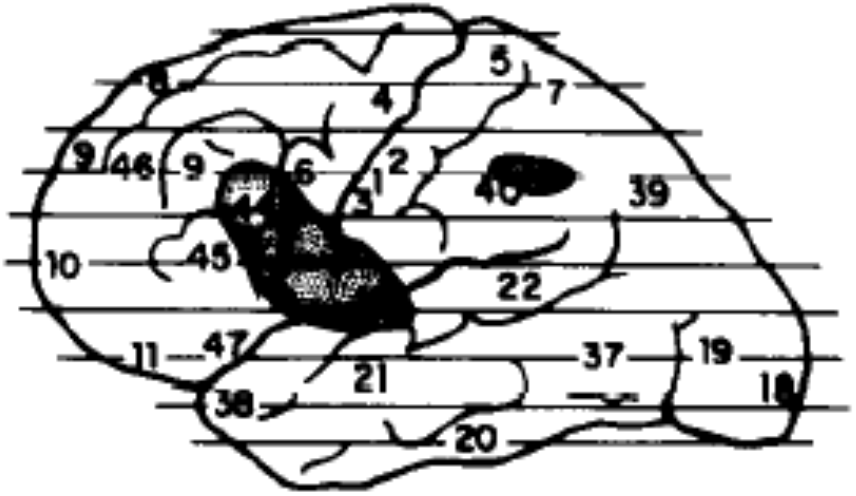
- Is sign language as left lateral as spoken language?

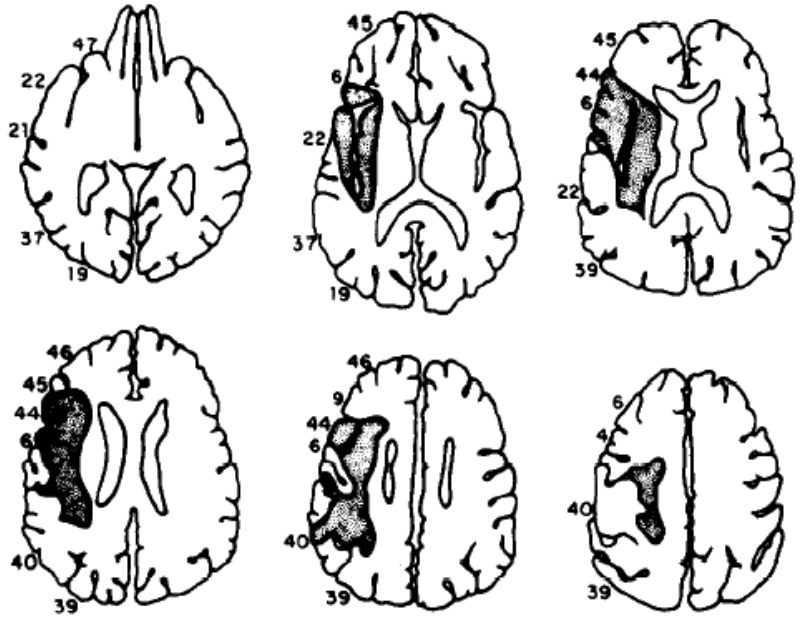
Is sign language as left lateral as spoken language?

- Classic evidence for the left laterality of spoken language comes from aphasia: left hemisphere damage is usually much more detrimental to language than right hemisphere damage.
- But the right hemisphere contributes importantly to spatial cognition.
- So maybe sign language is more right lateral..?

Corina et al.: Dissociation between Linguistic and Nonlinguistic Gestural Systems: A Case for Compositionality (1992) *Brain and Language*.

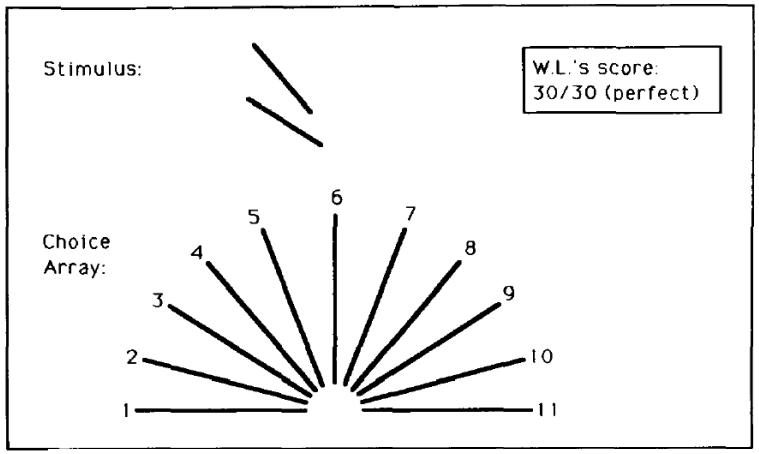
- WL
  - 76-year-old congenitally deaf right-handed male.
  - As a result of stroke, WL has a large frontotemporoparietal lesion in the left hemisphere.
    - Broca's area and subsequent white matter tracts, including arcuate fasciculus, were damaged.
    - Wernicke's area was not damaged.





Is WL's nonlinguistic spatial cognition preserved?

Benton Test of Judgment of Line Orientation



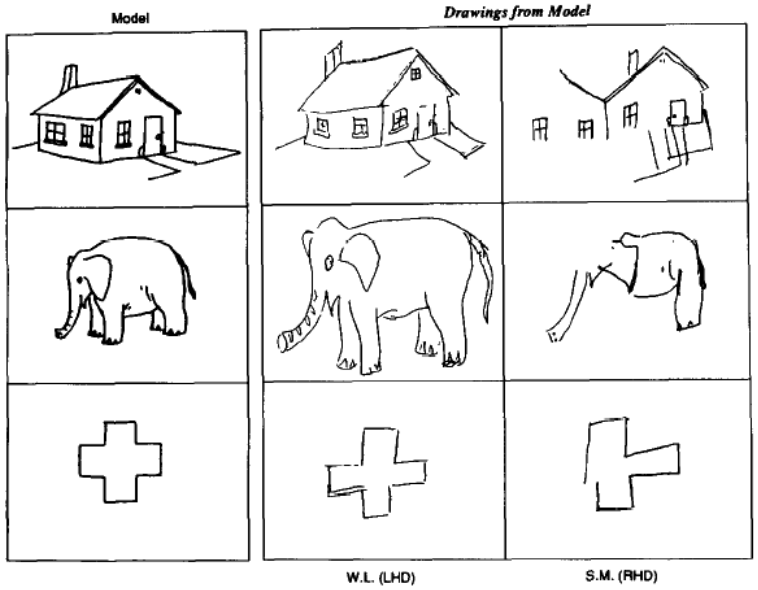
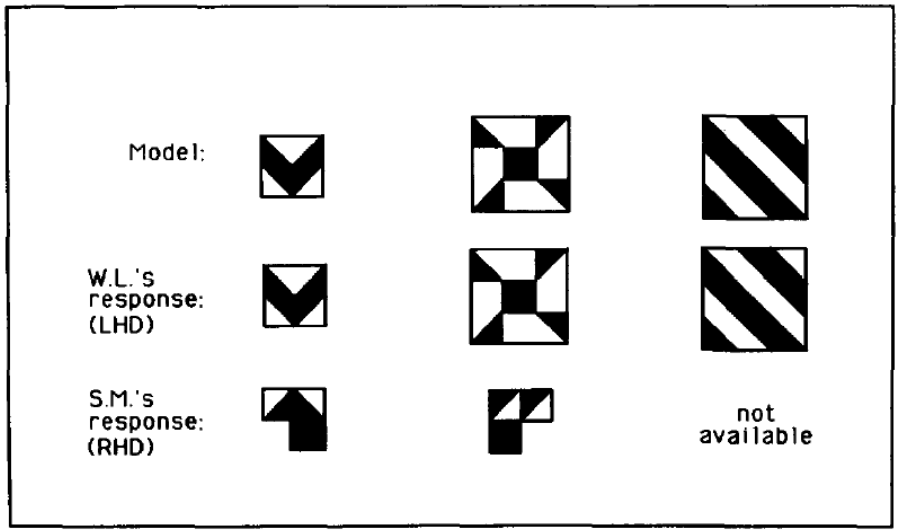


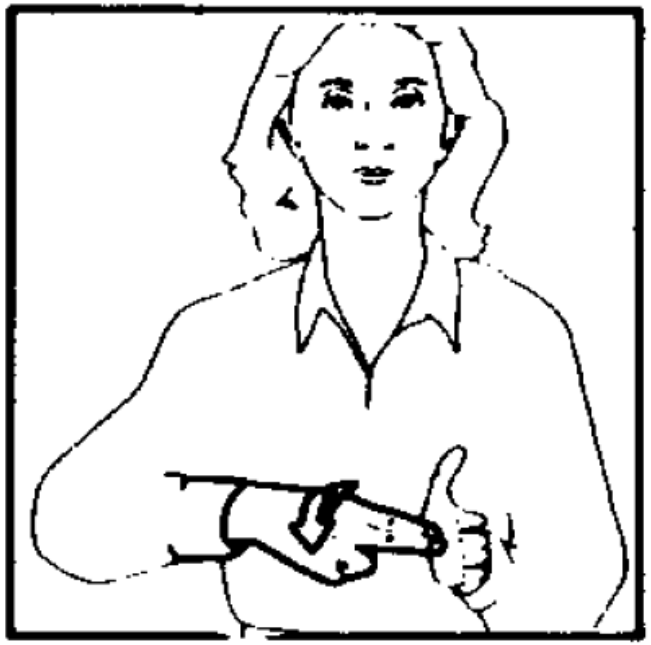
FIG. 6. Comparisons of drawings from model of left-lesioned W.L. and right-lesioned S.M., showing preservation of nonlanguage abilities in the left- as opposed to the right-lesioned signer.

WAIS-R Block Design Test



- Yes!
- So signing problems won't reflect general spatial cognition problems.

WL's impaired signing:
(1) Paraphasias (mispronounciations)



Sign: SCREWDRIVER

Paraphasia: Incorrect Handshape

FIG. 7. Phonological paraphasias from left-hemisphere-damaged signer W.L. implicate impairment of a specific phonological tier: handshape.

Corina et al.: Dissociation between Linguistic and Nonlinguistic Gestural Systems: A Case for Compositionality (1992) *Brain and Language*.

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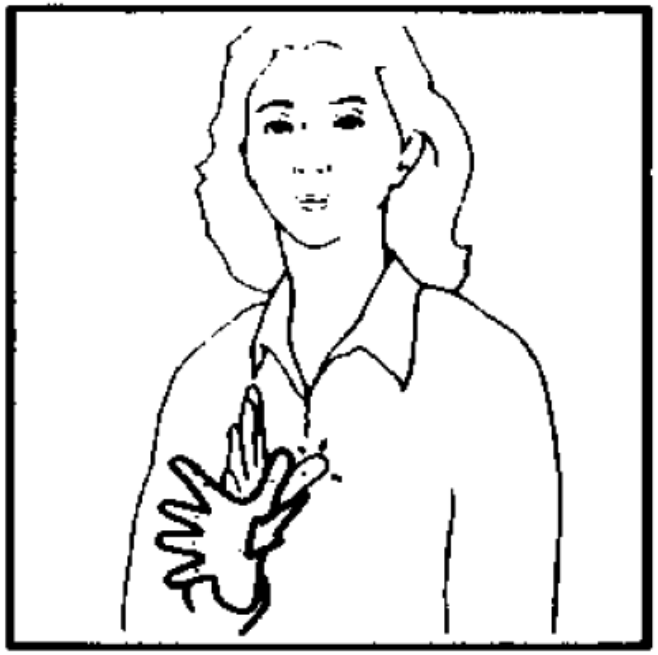

Sign: FINE

Paraphasia: Incorrect Handshape

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WL's impaired signing:
(1) Paraphasias (mispronounciations)

Sign: WHITE

Paraphasia: Incorrect Handshape Sequence

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WL's impaired signing:
(2) Substituting pantomime gestures for signs

PANTOMIME

"Smell"

SIGN

FLOWER

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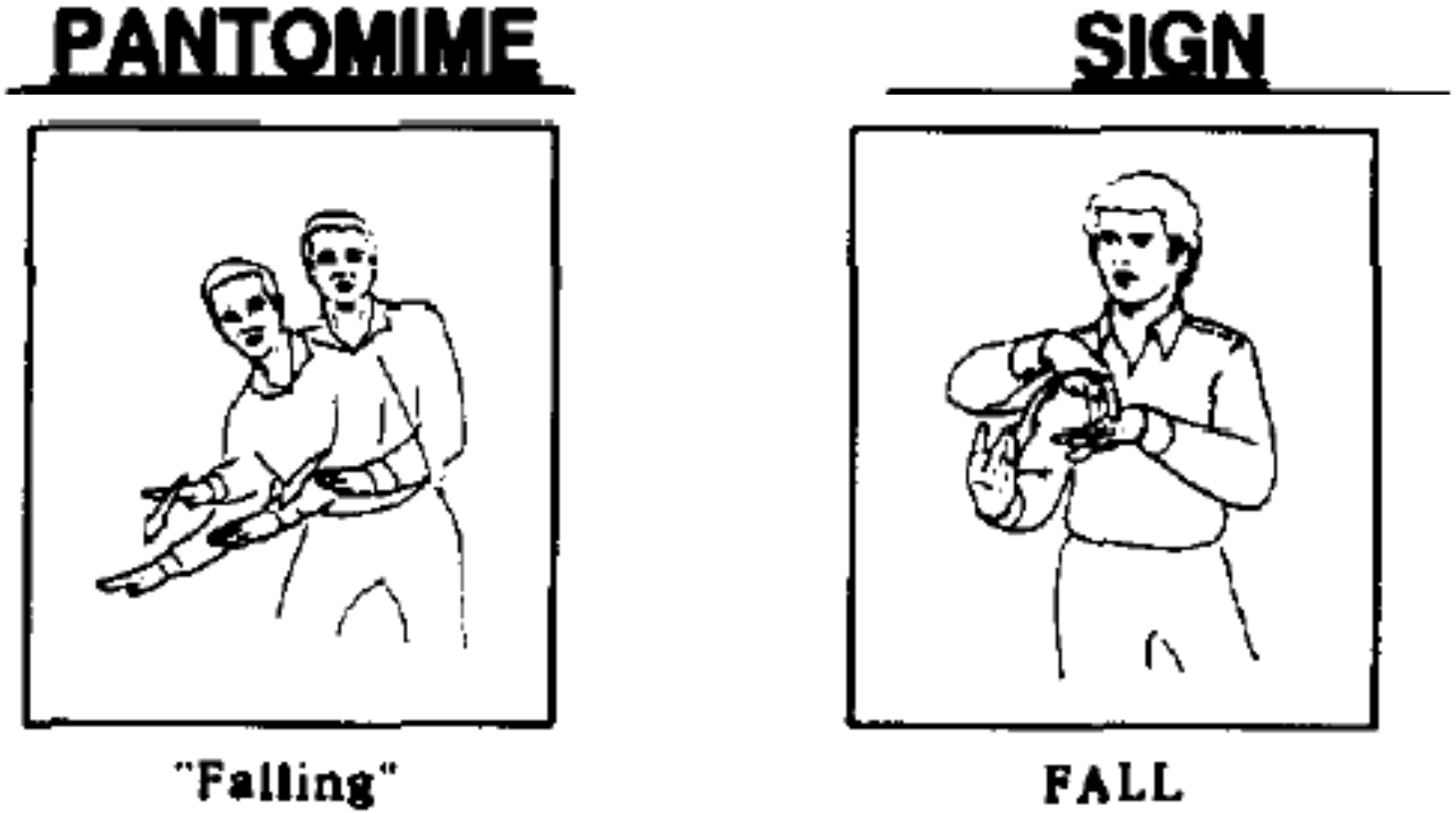

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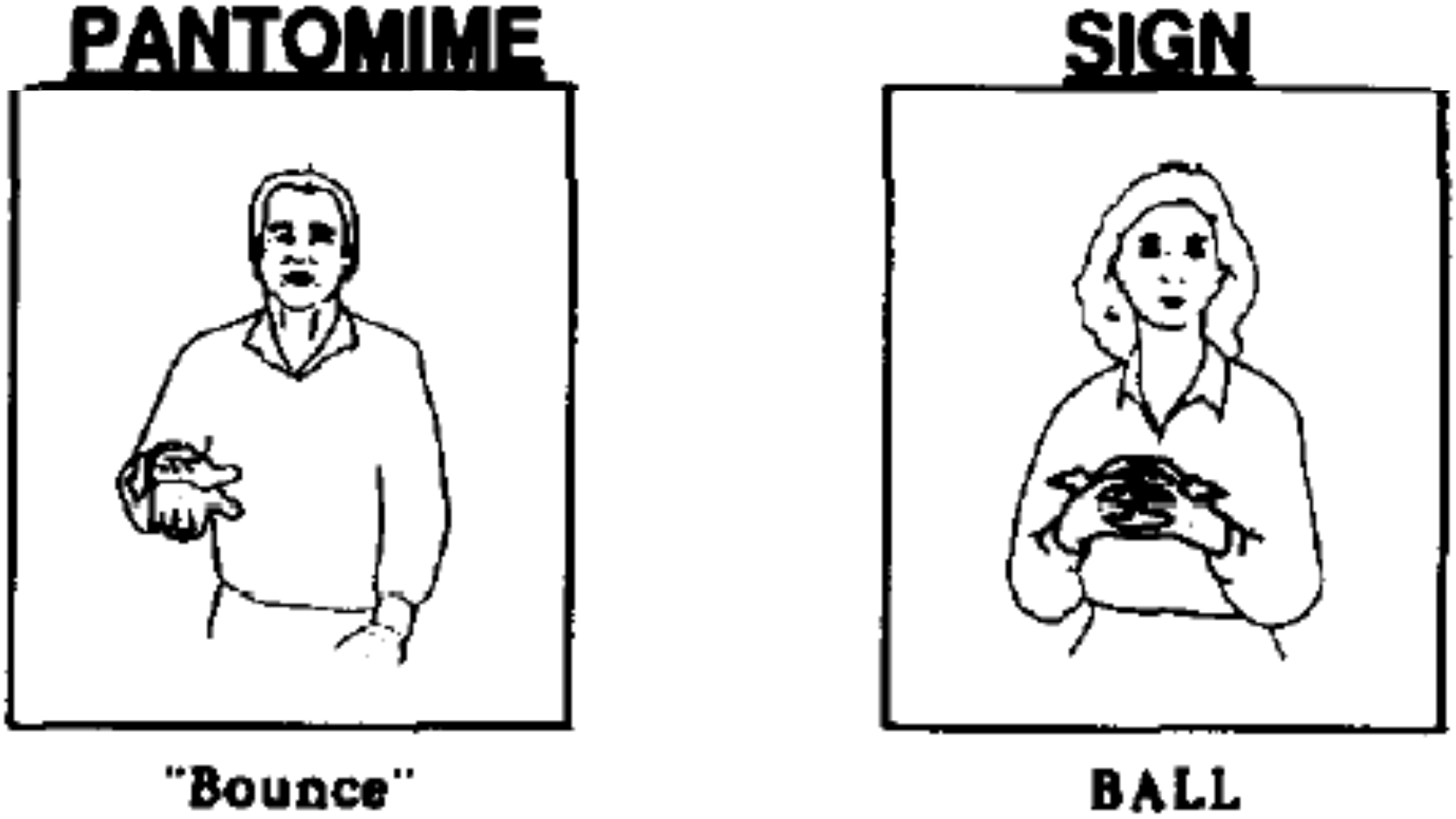

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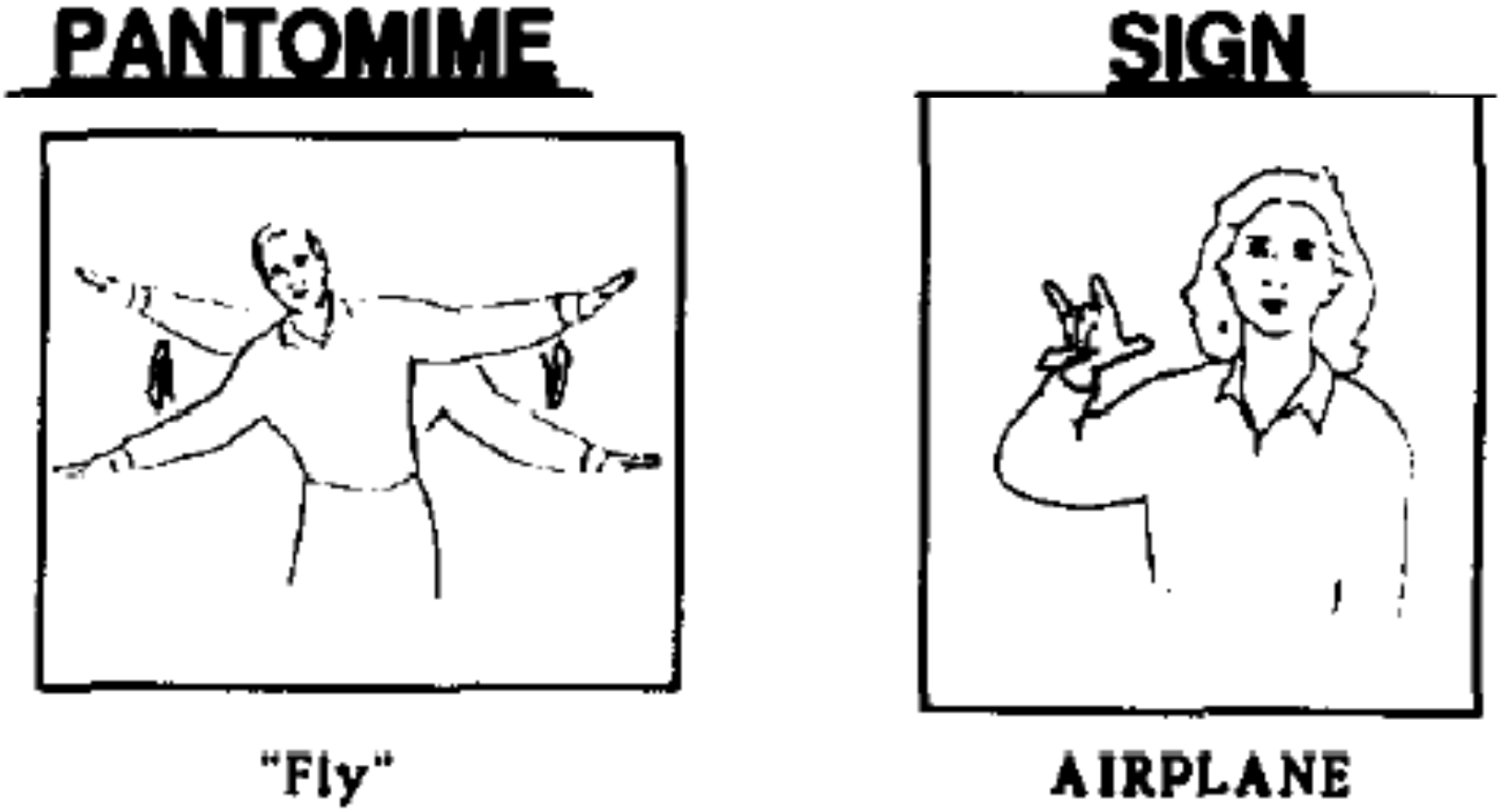

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- **WL's left lateral damage caused a language impairment and no impairment in spatial cognition or gesturing.**

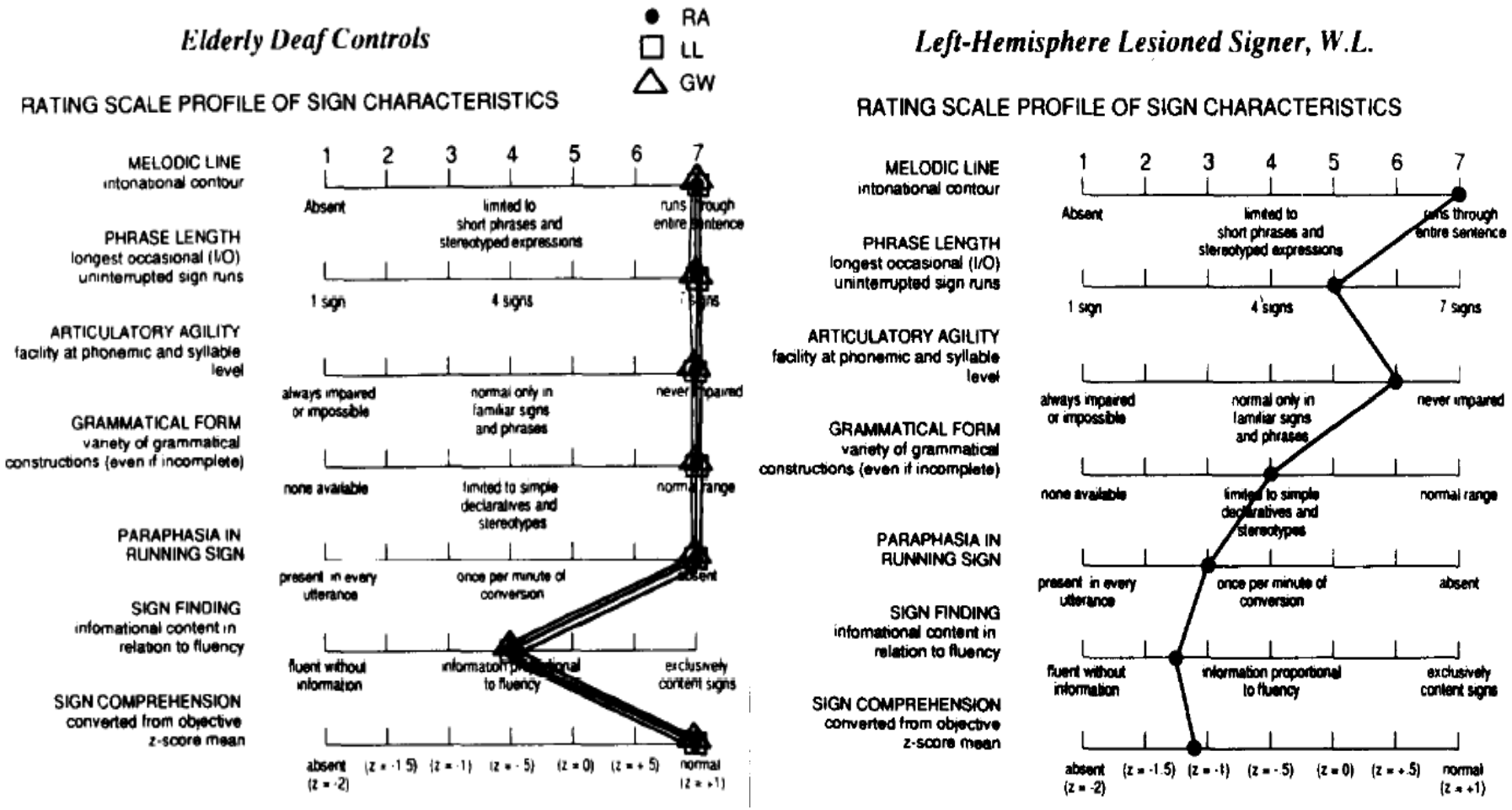

FIG. 4. Rating scale profiles of sign characteristics from the Salk Aphasia Examination, an ASL version of the Boston Diagnostic Aphasia Examination. Comparison of elderly deaf controls (top) and left-lesioned signer W.L. (bottom) reveals marked sign aphasia in W.L.

Hickok, G., Bellugi, U., & Klima, E. S. (1998). What's right about the neural organization of sign language? A perspective on recent neuroimaging results. *Trends in Cognitive Sciences*, 2(12), 465-468.

Group data

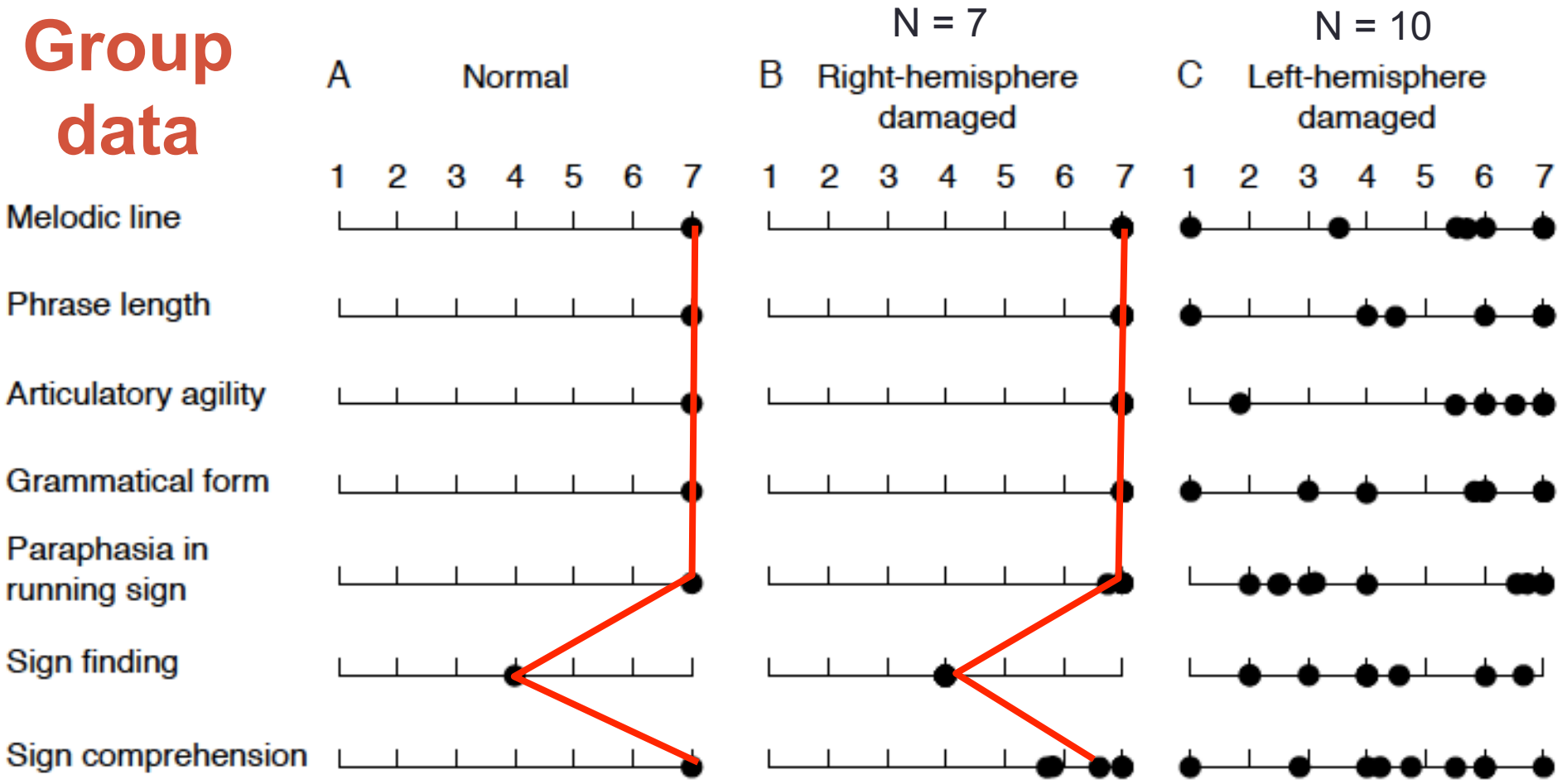

Fig. 1 Group data showing the effects of left- versus right-hemisphere damage on American Sign Language (ASL) ability in deaf life-long signers. Note that, relative to normal subjects **(A)** and patients with right-hemisphere damage (n = 7) **(B)**, left-hemisphere damaged patients (n = 10) **(C)** present with a range of deficits in ASL ability. The 7-point rating scales for each measure of performance are as follows: *Melodic line*, 'absent' (1) through 'limited to short, stereotypical phrases' (4) to 'runs through entire sequence' (7); *Phrase length*, from 'single signs' (1) to 'short strings of signs' (4) to 'normal length' (7); *Articulatory agility*, from 'always impaired' (1) through 'normal only in familiar signs and phrases' (4) to 'never impaired' (7); *Grammatical form*, from 'none' (1) through 'limited to simple declaratives and stereotypes' (4) to 'normal range' (7); *Paraphasia in running sign*, from 'always present' (1) through 'once per minute of conversation' (4) to 'absent' (7); *Sign finding*, from 'fluent without information' (1) through 'information proportional to fluency' (4; normal condition) to 'exclusively content signs' (7); *Sign comprehension*, from 'absent' to 'normal'.

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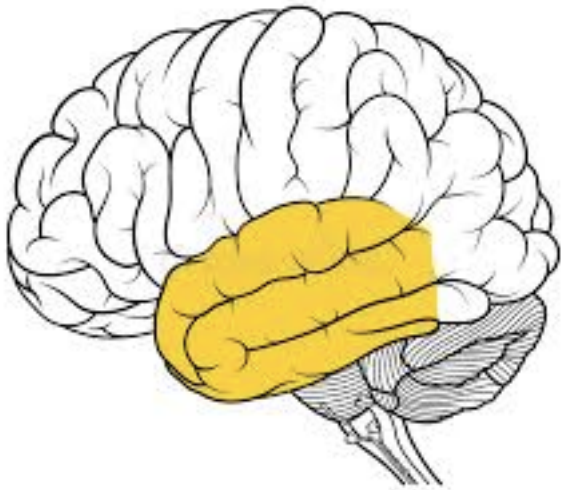
Lexical access **Composition**

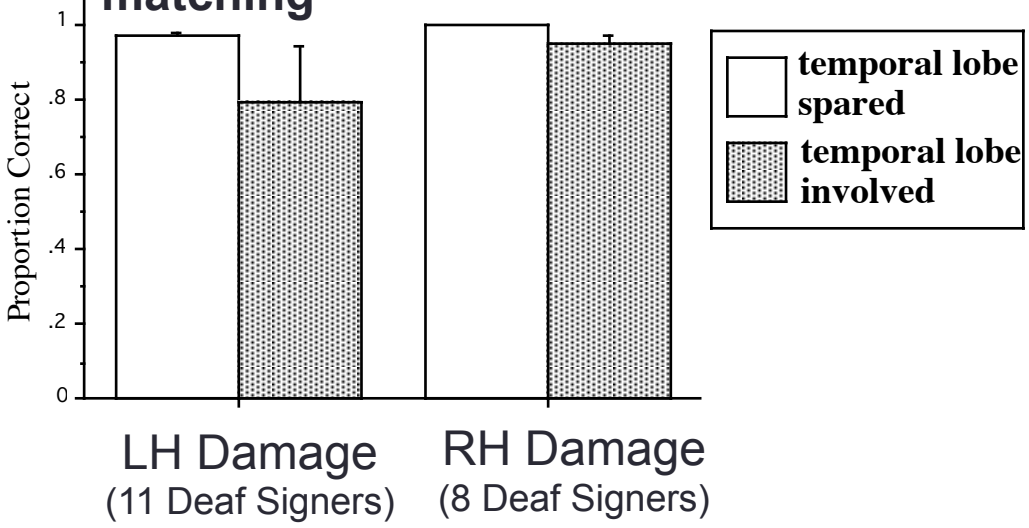


Does left *temporal* damage specifically impair sign access and composition?

Hickok, G., Love-Geffen, T., & Klima, E. S. (2002).
Role of the left hemisphere in sign language comprehension. Brain and Language, 82(2), 167-178.

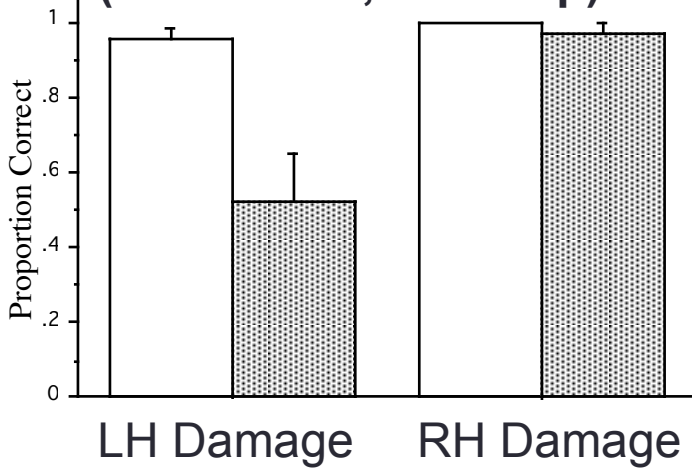
Lexical access

Single sign-to-picture matching

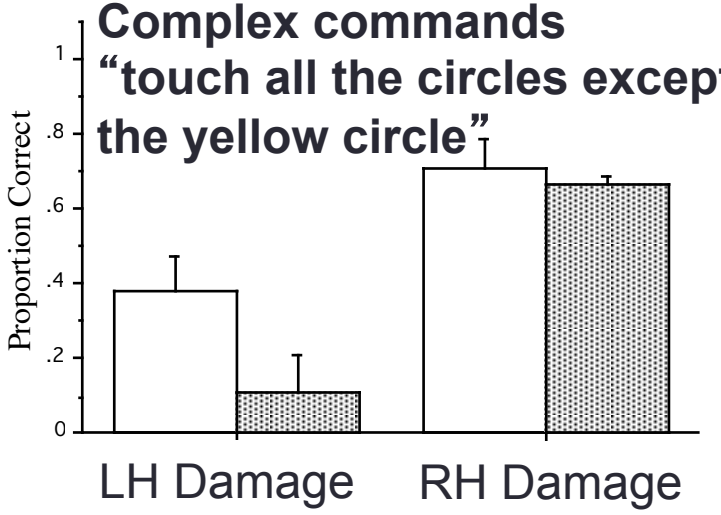


Composition

Simple commands (one clause, one step)

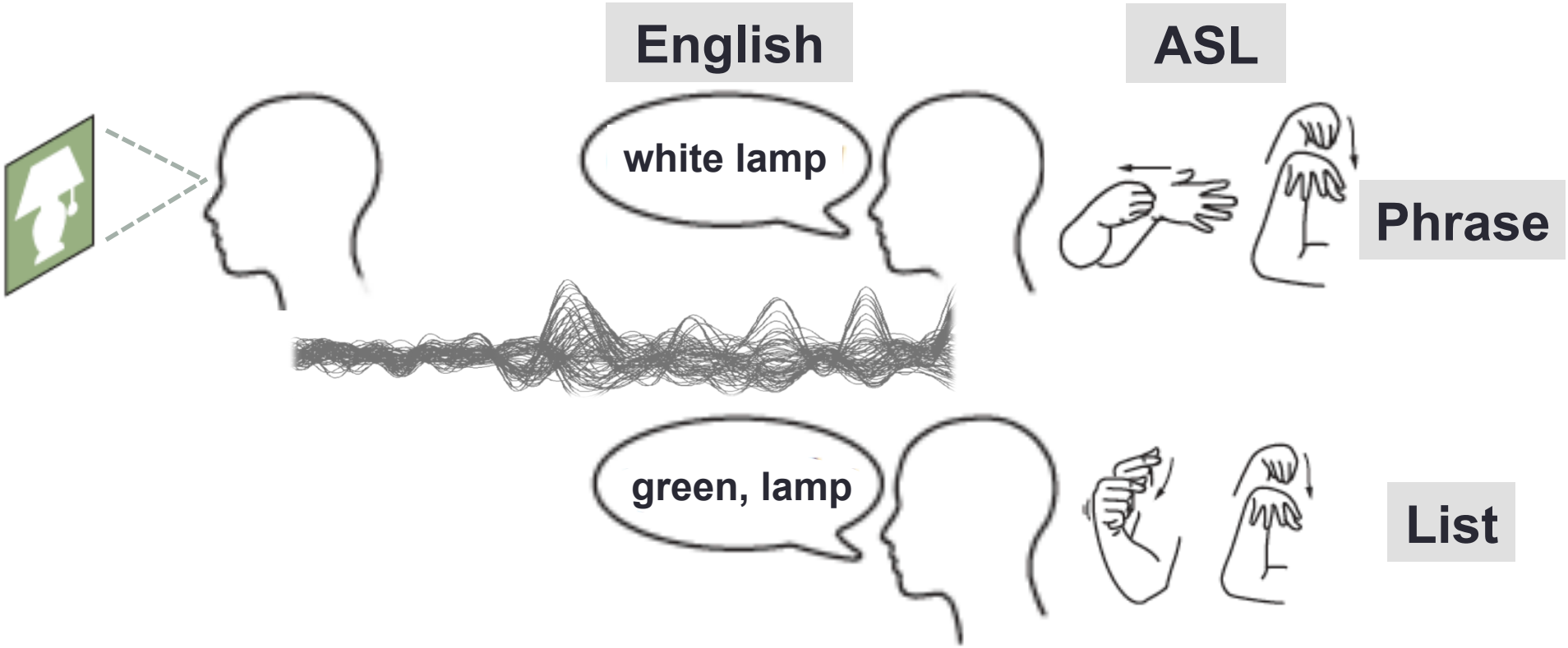


Complex commands "touch all the circles except the yellow circle"



Evidence for left *temporal* localization of lexical access and combinatory processing also for sign.

Blanco-Elorrieta, E., Kastner, I., Emmorey, K., & Pylkkänen, L. (2018). Shared neural correlates for building phrases in signed and spoken language. *Scientific reports*, 8(1), 1-10.



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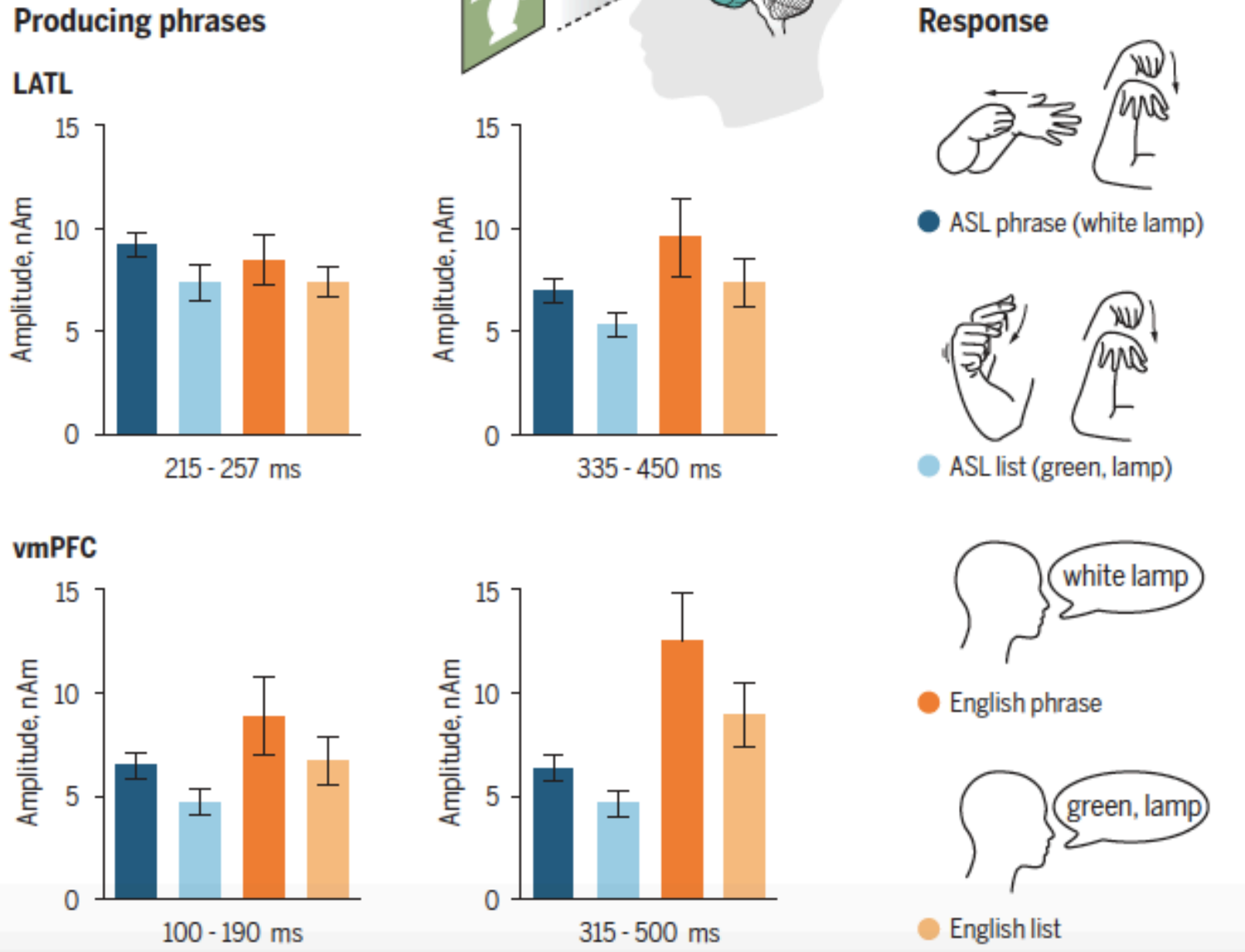

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There are similarities in the neural processing of sign and speech even at a more-grained level, including time-course of specific processes in a specific part of the temporal cortex..

This suggests that it is unlikely that the clustering of various linguistic functions in left temporal cortex is because of the proximity to auditory cortex.